

**Detailed Program**

**Bachelor of Computer Applications**  
**(BCA)**

**Semester-VI**  
**(2023-2027)**

DOC202306080070



**RNB GLOBAL UNIVERSITY**

RNB Global City, Ganganagar Road,  
Bikaner, Rajasthan 334601

## **OVERVIEW**

RNB Global University follows Semester System along with Choice Based Credit System as per latest guidelines of University Grants Commission (UGC). Accordingly, each academic year is divided into two semesters, **Odd (July-December)** and **Even (January-June)**. Also, the university follows a system of continuous evaluation along with regular updating in course curricula and teaching pedagogy.

The curriculum for BCA Program for (January-June) even Semester, 2026 along with examination pattern is as follows:

### **Course Scheme**

#### **Semester –VI**

| S. No        | Course Code | Course Category | Course Name   | L         | T        | P         | Credits   |
|--------------|-------------|-----------------|---|-----------|----------|-----------|-----------|
| 1.           | 13013100    | DSC 17          | Software Testing and Quality Assurance                          | 3         | 1        | 0         | 4         |
| 2.           | 13013200    | DSC 18          | Theory of Computation   | 3         | 1        | 0         | 4         |
| 3.           |             | DSE 4 (a)       | One from the Pool of DSE Courses                                | 3         | 0        | 0         | 3         |
| 4.           |             | DSE 4 (b)       | One from the Pool of DSE Courses                                | 0         | 0        | 2         | 1         |
| 5            | 13012700    | DSC 19          | Mobile Computing  | 3         | 1        | 0         | 4         |
|              |             | GE-4            | One from the Pool of GE Group –B                                | 3         | 1        | 0         | 4         |
| 6            | 99003800    | IAPC – 4        | Internship/Apprenticeship / <b>Project</b> / Community Outreach | 0         | 0        | 8         | 4         |
| 8            | 99003300    |                 | Workshops & Seminars/ Human Values & Social Service/NCC/NSS     | -         | -        | -         | 1         |
| <b>Total</b> |             |                 |   | <b>15</b> | <b>4</b> | <b>10</b> | <b>25</b> |

**DSC** – Discipline specific Course

**DSE** – Discipline Specific Elective

**SEC** – Skill Enhancement Course

**VAC** – Value addition course

**GE** – General Elective

## **ELECTIVES**

### **Discipline Specific Course**

| Discipline Specific Electives (DSE) |             |                                      |   |   |   |         |
|-------------------------------------|-------------|--------------------------------------|---|---|---|---------|
| S.No                                | Course Code | Course Name                          | L | T | P | Credits |
| 1.                                  | 13013300    | Unix & Shell programming (DSE 4)     | 3 | 0 | 0 | 3       |
| 2.                                  | 13013400    | Unix & Shell programming lab (DSE 4) | 0 | 0 | 2 | 1       |

| General Elective Courses (GE) |          |                  |   |   |   |   |
|-------------------------------|----------|------------------|---|---|---|---|
| Group B Even Semester         |          |                  |   |   |   |   |
| 1.                            | 11026600 | Machine Learning | 4 | 0 | 0 | 4 |

## **EVALUATION SCHEME- THEORY**

The evaluation of the theory paper of BCA would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessments as follows:

### **Internal Assessment**

The distribution of Internal Assessment Marks is as follows:

| Type   | Details   | Marks |
|--|---|-------|
| Mid Term   | Two Mid-term Sessional of 15 marks each (15+15) | 30    |
| Marks obtained in various Tests, Assignments, Presentations, Quiz, Tutorials, etc. | Average of marks obtained                       | 15    |
| Attendance   | 75%+ : 5 marks                                  | 5     |
| <b>TOTAL</b>   | <b>50</b>                                       |       |

### **External Assessment**

| Type   | Marks |
|--------|-------|
| Theory | 50    |

## **EVALUATION SCHEME -PRACTICAL**

The evaluation of the practical paper of BCA would be based on Internal and

External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessment is as follows:

#### **Internal Assessment**

| Type  | Details                   | Marks |
|---|---------------------------|-------|
| Marks obtained in various manuals, practical file, participation, any model prepared, output of practical | Average of marks obtained | 45    |
| Attendance  | 75%+ : 5 marks            | 5     |
| <b>TOTAL</b>  | <b>50</b>                 |       |

#### **External Assessment**

| Type      | Marks |
|-----------|-------|
| Practical | 50    |

#### **EVALUATION SCHEME- WORKSHOPS & SEMINARS AND HUMAN VALUES & SOCIAL SERVICE/NCC/NSS**

1. The evaluation of Workshops & Seminar and Human Values & Social Service/NCC/NSS will be completed from Semester I – Semester VI. It will be evaluated internally by the various Forums & Schools Concerned. The credit for this will be given at the end of each Semester.
2. The students have to join club/clubs/Forums with the active participation in different activities of club. The students would be continuously assessed from Semester-I to Semester-IV and credits and marks would be given after the end of each Semester

## **1. Vision**

To create an environment where a holistic education is given in order to ignite an inquisitive mind, inculcate the qualities of excellence, perceive the intricacies of research, seek out obstacles, overcome them, and carve out a niche for oneself.

## **2. Mission**

- Enabling students to maximize their potential and use their professional standards through ethics and education to raise their level of competence and become change agents.
- Fostering a scholarly culture that fosters the phenomenon of giving back to society via research and creative endeavours.
- To integrate partnerships that enhance knowledge in order to create a dynamic intellectual capital.
- To employ emerging technology to create an inclusive learning environment that is integrated with an improved educational process.
- To create a teaching-learning atmosphere that fosters resilience, sensitivity, and critical thinking, ultimately leading to the development of a strong personality.

## **3. Programme Educational Objectives (PEOs)**

**PEO1:** To facilitate in development of basic fundamentals of Computer Applications that fit as a perfect foundation towards a beginning a professional career in industry.

**PEO2:** To develop programming skills of students by using fundamental knowledge of computer science

**PEO3:** To apply new designs and solutions to complex real-life problems using technologies.

**PEO4:** To play a creative role during professional life through turning problems to opportunities.

#### 4. Program Outcome (Pos)

- P01: Technical understanding:** Solve complicated problems using mathematics, physics, technical foundations, and a specialization in technology.
- P02: Problem analysis:** Identify, formulate, analyze research materials, and analyse complex engineering problems using foundational principles of mathematics, natural sciences, and sciences to reach justifiable conclusions.
- P03: Application of modern technologies:** Create, select, and apply appropriate approaches, tools, and advanced engineering and IT tools, such as predictions and modelling, to technically challenging processes while taking into account the constraints.
- P04: Expert Principles and Cyber Systems:** The ability to use and provide expert principles and cyber systems in a global monetary environment.
- P05: Ultimate Education:** Determine the demand for and expand the capacity to work as a Computing certified in permanent education.
- P06: The expert and society:** Apply reasoning informed by contextual information to evaluate societal, health, safety, legal, and cultural issues, as well as the obligations that come with them, in the context of professional engineering activity.
- P07: Environmental and sustainable development:** Display knowledge of the need for sustainable development by identifying the implications of professional technological solutions in society and the environment contexts.
- P08: Personality and Cooperative Learning:** Ability to work as a member or manager in a variety of diverse teams.
- P09: Ethics:** Adhere to professional ethics, duties, and automotive technology norms by adopting ethical ideas.
- P010: Communication:** Interact well with the technical community and society at large on associated technical activities, such as being able to understand and write effective reports and design documentation, give and receive clear directions.
- P011: Finance and project management:** Demonstrate knowledge and understanding of technical and professional principles and apply those to one's own work, as a member of the team and leader, to manage projects and in multidisciplinary domains.
- P012: Life-long learning:** With socio-technological advancements, students will be able to engage in independent and life-long learning.

## **5. Program Specific Outcome (Psos)**

**PS01:** Prepare for a potentially lucrative and employable profession of computer applications.

**PS02:** Continue your education in Computer Science/Applications.

**PS03:** Work for yourself in the Indian and worldwide software markets.

**PS04:** Comply with all applicable industrial standards.

| <b>6. Course Outcomes</b>                                 |  |  |
|---|--|--|
| <b>Course Codes &amp; Course Names</b>                    | <b>After completion of these courses' students should be able to</b> |  |
| 13013100-<br>Software Testing<br>and Quality<br>Assurance | <b>CO1:</b>  | Show modern software testing processes in relation to software development and project management.   |
|   | <b>CO2:</b>  | Illustrate test strategies and plans, design test cases, prioritize and execute them.  |
|   | <b>CO3:</b>  | Organize incidents and risks within a project.   |
|   | <b>CO4:</b>  | Discover various automation tools  |
|   | <b>CO5:</b>  | Create test strategies   |
| 13013200-<br>Theory of<br>Computation                     | <b>CO1:</b>  | Define and the concepts of formal languages of finite automata techniques  |
|   | <b>CO2:</b>  | Illustrate Finite Automata's for different Regular Expressions and Languages   |
|   | <b>CO3:</b>  | Construct context free grammar for various languages   |
|   | <b>CO4:</b>  | Distinguish various problems of applying normal form techniques, push down automata and Turing Machines  |
|   | <b>CO5:</b>  | Support in participation in GATE, PGECET and other competitive examinations  |
| 13013300-<br>Unix & Shell<br>Programming                  | <b>CO1:</b>  | How to describe and use the UNIX operating system  |
|   | <b>CO2:</b>  | Demonstrate and use the fundamental UNIX system tools and utilities  |
|   | <b>CO3:</b>  | Identify and write shell scripts in order to perform basic shell programming   |
|   | <b>CO4:</b>  | Examine and understand the UNIX file system.   |
|   | <b>CO5:</b>  | Explain the UNIX file system with its practical use  |
| 13013400-<br>Unix & Shell<br>Programming<br>Lab           | <b>CO1:</b>  | Recall UNIX structure, commands, and utilities   |
|   | <b>CO2:</b>  | Explain and understand the UNIX file system  |
|   | <b>CO3:</b>  | Construct shell scripts in order to perform shell programming  |
|   | <b>CO4:</b>  | Classify knowledge about text processing utilities, process management and system operation of UNIX  |
|   | <b>CO5:</b>  | Justify physical points of vulnerability   |
| 13012700 -<br>Mobile<br>Computing                         | <b>CO1:</b>  | Infer the core concepts of the cloud computing paradigm  |
|   | <b>CO2:</b>  | Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency and cost, and then study how to leverage and manage single and multiple data centers to build and deploy cloud applications that are resilient, elastic and cost-efficient. |
|   | <b>CO3:</b>  | Contrast system, network and storage virtualization and outline  |



|                                  |             |  |
|----------------------------------|-------------|--|
|                                  |             | their role in enabling the cloud computing system model  |
|                                  | <b>CO4:</b> | Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS                 |
|                                  | <b>CO5:</b> | Justify how to leverage and manage single and multiple data centers  |
| 11026600-<br>Machine<br>Learning | <b>CO1:</b> | Able to categorize the problems as supervised or unsupervised and to apply regression algorithm for prediction problems                      |
|                                  | <b>CO2:</b> | Select and apply supervised algorithms like Naïve bayes algorithm, decision tree and analyze the models using different evaluation parameter |
|                                  | <b>CO3:</b> | To build ML models using KNN, SVM classifiers and to perform feature engineering and selection using PCA and LDA.                            |
|                                  | <b>CO4:</b> | To Apply different clustering algorithms for the unlabeled data and interpret the results  |
|                                  | <b>CO5:</b> | Understand the fundamental concepts of deep learning   |

## 7.CO PO Mapping

| 13013100 | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01      | 2   | 3   | -   | 2   | -   | 1   | 3   | -   | 3   | 3    | 2    | 3    |
| C02      | 3   | -   | 3   | 3   | 3   | 2   | 2   | 3   | -   | -    | 3    | 3    |
| C03      | 2   | 2   | 3   | 2   | 2   | 3   | 3   | 2   | 3   | 3    | 3    | 3    |
| C04      | 1   | 3   | 3   | -   | 2   | -   | 2   | 3   | 2   | 3    | -    | 3    |
| C05      | 3   | 3   |     | 3   |     | 3   |     | 3   |     | 3    | 3    |      |

| 13013200 | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01      | 2   | 3   | -   | 2   | -   | 1   | 3   | -   | 3   | 3    | 2    | 3    |
| C02      | 3   | -   | 3   | 3   | 3   | 2   | 2   | 3   | -   | -    | 3    | 3    |
| C03      | 2   | 2   | 3   | 2   | 2   | 3   | 3   | 2   | 3   | 3    | 3    | 3    |
| C04      | 1   | 3   | 3   | -   | 2   | -   | 2   | 3   | 2   | 3    | -    | 3    |
| C05      |     | 3   | 3   |     | 3   |     | 3   |     | 3   | 3    | 3    |      |

| 13013300 | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01      | 2   | 3   | -   | 2   | -   | 1   | 3   | -   | 3   | 3    | 2    | 3    |
| C02      | 3   | -   | 3   | 3   | 3   | 2   | 2   | 3   | -   | -    | 3    | 3    |
| C03      | 2   | 2   | 3   | 2   | 2   | 3   | 3   | 2   | 3   | 3    | 3    | 3    |
| C04      | 1   | 3   | 3   | -   | 2   | -   | 2   | 3   | 2   | 3    | -    | 3    |
| C05      |     | 2   | 2   | 3   | 3   |     | 3   | 3   |     | 3    |      | 2    |

| 13013400 | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01      | 2   | 3   | -   | 2   | -   | 1   | 3   | -   | 3   | 3    | 2    | 3    |
| C02      | 3   | -   | 3   | 3   | 3   | 2   | 2   | 3   | -   | -    | 3    | 3    |
| C03      | 2   | 2   | 3   | 2   | 2   | 3   | 3   | 2   | 3   | 3    | 3    | 3    |
| C04      | 1   | 3   | 3   | -   | 2   | -   | 2   | 3   | 2   | 3    | -    | 3    |
| C05      | 1   |     | 3   | 3   |     | 3   | 2   |     | 2   | 3    | 3    |      |

| 13012700 | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01      | 2   | 3   | -   | 2   | -   | 1   | 3   | -   | 3   | 3    | 2    | 3    |
| C02      | 3   | -   | 3   | 3   | 3   | 2   | 2   | 3   | -   | -    | 3    | 3    |
| C03      | 2   | 2   | 3   | 2   | 2   | 3   | 3   | 2   | 3   | 3    | 3    | 3    |
| C04      | 1   | 3   | 3   | -   | 2   | -   | 2   | 3   | 2   | 3    | -    | 3    |
| C05      |     | 3   |     | 3   |     | 3   |     | 3   |     | 3    |      | 3    |

| 11026600 | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01      | 2   | 2   |     | 3   | 2   | 3   |     | 3   |     | 3    | 2    | 2    |
| C02      | 2   | 2   | 3   |     |     |     |     | 2   | 3   | 3    |      | 2    |
| C03      |     | 2   |     |     | 3   | 2   |     | 3   |     | 3    | 3    | 2    |
| C04      | 2   | 2   | 3   | 3   | 2   | 2   |     |     | 3   | 3    | 3    | 3    |
| C05      | 3   | 3   |     | 3   | 3   |     | 3   | 3   | 2   |      | 2    | 2    |

## **8. Curriculum**

**Course Name: Software Testing and Quality Assurance**

**Course Code: 13013100**

### **Objectives**

After completing this course, students will be able to: Introduce to Terminology, error, fault and failures, design for testability, objectives, principles, Purpose of testing, testing and debugging. Limitations of testing, Role of V&V in Software Evolution, Different types of Testing Techniques and Strategies. Also Discuss Flow graphs and Path Testing, Transaction Flow Testing, Data Flow Testing. Discuss about Software Testing and Regular Expression, Program Mutation Testing, Laboratory Work.

### **Course Outline**

#### **Unit I**

**Software Testing** – Psychology of Testing, Verification and Validation, Testing Team and Development Team, Characteristics of Test Engineers, Levels of Testing, Top-Down versus Bottom-Up Testing, Types of Testing – Black Box, White Box, Gorilla, Beta, Field, Performance, Stress and Acceptance Testing, Criteria for Completion of Testing, Manual Testing and its Limitations.

#### **Unit II**

**Overview of Testing Tools** – Need for Automated Testing Tools, Taxonomy of Testing Tools, Functional/Regression Testing Tools, Performance Testing Tools, Testing Management Tools, Source Code Testing Tools, How to select a Testing Tool. • WinRunner – Overview of WinRunner, Testing Applications using WinRunner.

#### **Unit III**

**Software Quality Assurance** – Software Engineering, Criteria for the Success of Software Project, Process-Oriented Software Development, the Management Process. Metrics in Software Development, Documentation.

#### **Unit IV**

Quality Standards, ISO 9000 Series Standards, Quality Process Implementation Issues.

#### **Suggested Readings:**

1. K.V.K.K. Prasad, "Software Testing Tools", Dreamtech Press.
2. Louise Tamres, "Introducing Software Testing", Pearson Education.
3. Borris Beizer, "Software Testing Techniques", Dreamtech Press.

## **Course Name: Theory of Computation**

**Course Code: 13013200**

### **Objectives**

1. To introduce students to the mathematical foundations of computation including automata theory.
2. To be able to understand the concept of theory of formal languages and grammars and the notions of algorithm, decidability, complexity, and computability.
3. To enhance/develop students' ability to understand and conduct mathematical proofs for computation and algorithms.
4. To enhance the ability to understand the concept of Regular Expression Formalism.
5. To be able to describe formation of Turing machine by Grammars

### **Course Outline**

#### **Unit I**

Review of Mathematical Preliminaries: Set, Relations and functions, Graphs and trees, string, alphabets and languages. Principle of induction, predicates and propositional calculus. Theory of Automation : Definition, description, DFA,NFA, Transition systems,2DFA, equivalence of DFA & NDFA, Regular expressions, regular grammar, FSM with output (mealy and moore machines), Minimization of finite automata.

#### **Unit II**

Formal Languages: Definition & description, Phrase structured grammars & their classification, Chomsky classification of languages, closure properties of families of language, regular grammar, regular set & their closure properties, finite automata, equivalence of FA and regular expression.

#### **Unit III**

Context-Free grammar & PDA: Properties unrestricted grammar & their equivalence, derivation tree simplifying CFG, unambiguous CFG, productions, normal form for CFG, Pushdown automata, 2 way PDA, relation of PDA with CFG, Determinism & Non determinism in PDA & related theorems, parsing and pushdown automata.

#### **Unit IV**

Turing Machine: Model, design, representation of TM, language accepted by TM, universal turing machine, determine & non-determinism in TM, TM as acceptor/generator/algorithms, multidimensional, multi tracks, multi tape, Two way infinite tape, multi head, Halting problems of TM.

### **Suggested Readings:**

- Hopcroft& Ullman "Introduction to Automata theory, languages & Computation"  
Narosha Publishing house.

- Lewish Papadimutrau "Theory of Computation", Prentice Hall of India, New Delhi.
- Peter linz, "An Introduction to formal language and automata", Third edition, Narosa publication.
- 4. Marvin L. Minsky "Computation: Finite & Infinite Machines", PHI.
- Mishra & Chander Shekhar "Theory of Computer Science

## **Course Name: UNIX & Shell Programming**

**Course Code: 13013300**

### **Objectives**

- To State how the shell functions at the user interface and command line interpreter.
- To modify built-in shell variables and create and use user-defined shell variables.
- To use I/O redirection, pipes, quoting, and filename expansion mechanisms.
- To create structured shell program that accept and use positional parameters and exported variables.
- To use shell flow control and conditional branching constructs while, for, case, if, etc.

### **Course Outline**

#### **Unit I**

Unix, Unix Architecture, UNIX Operating System, Unix File system, Directory Management , File Permission / Access Modes,

#### **Unit II**

Unix - Environment, Basic Utilities, Pipes and Filters, Processes Management The Bourne Shell, Network Communication Utilities. The vi Editor.

#### **Unit III**

Unix Shell Programming: Shell, Shell Variables, Special Variables, Shell Arrays, Shell Basic Operators, Shell Decision Making, Shell Loop Types, Shell Loop Control.

#### **Unit IV**

Shell Input/output, Shell Functions, File System Basics, User Administration, Programming with the Shell Introduction to System administration.

### **Suggested Readings:**

1. UNIX-Concepts & Applications, Sumitava Das, TMH
2. Learning UNIX Operating System, Peek, SPD/O'REILLY
3. Understanding UNIX, Srirengan, PHI
4. Learning the Vi Editor, Lamb, SPD/O'REILLY
5. Essentials Systems Administration, Frisch, SPD/O'REILLY

## **CourseName: UNIX & Shell Programming Lab**

**Course Code: 13013400**

### **Objectives**

- To use I/O redirection, pipes, quoting, and filename expansion mechanisms.
- To create structured shell program that accept and use positional parameters and exported variables.
- To use shell flow control and conditional branching constructs while, for, case, if, etc

### **Course Outline**

1. Write a shell program to find the largest of 3 numbers using command line arguments.
2. Write a shell program to compare two strings given by the user.
3. Write a shell program to concatenate the contents of two files.
4. Write a shell program to find sum of digits of a given number.
5. Write a Shell Script to convert a binary number to its decimal equivalent.
6. Write a Shell Script to print the multiplication table.
7. Write Shell Scripts to compute the factorial value with and without using recursive functions.
8. Write a shell program to remove the files of the same size in the current directory
9. Write a shell program to convert all lower case into upper case and vice versa in a file using command line arguments.
10. Write a Shell Script to prepare and display the Electricity bill with significant considerations.
11. File handling system.
  - a. create a file
  - b. copy the file
  - c. move the file
  - d. delete the file
  - e. exit
12. Write a menu based program to permit or remove read/write/execute permission of a file.
13. Write a shell program to calculate the net salary of an employee in a particular month. Considering various allowances (TA, DA, and HRA) and deductions (income tax) as: TA = 15 % of Basic salary DA = 2 % of Basic salary HRA = 10 % of Basic salary  
Income tax = 5% of salary PF = 10 % of salary
14. Students marks sheet processing.
15. Write a shell program which will
  - a. ask the user to enter a filename
  - b. check if the file is ordinary file and is readable
  - c. display the file if the file is ordinary and readable
  - d. display an error message if the file is not ordinary and/or not readable

## **Course Name: Mobile Computing**

**Course Code: 13012700**

### **Objective:**

- The Course based on Waves and Signals and it covers following topics: Basic Knowledge of wireless communications, Elementary Knowledge on Wireless Transmission, Elementary Knowledge on Medium Access Control, Elementary Knowledge on Telecommunications Systems, Mobile Internet, Implementing WAP Services: WML, Implementing WAP (Wireless Application Protocol) Services.

### **Course Outline**

#### **Unit I: Introduction to wireless communications**

Applications, Short History of Wireless Communications, Market of Mobile Communications. **Elementary Knowledge on Wireless Transmission:** Frequency of Radio Transmission, Signals, Antennas, Signal Propagation: Path Loss of Radio Signals, Additional Signal Propagation Effects, Multipath Propagation, Multiplexing: Space Division Multiplexing, Frequency Division Multiplexing, Time Division Multiplexing, Code Division

Multiplexing, Modulation: Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Advanced Frequency Shift Keying, Advanced Phase Shift Keying, Multicarrier Modulation, Spread Spectrum: Direct Sequence Spread Spectrum, Frequency Hopping Spread Spectrum, Cellular Systems.

#### **Unit II: Elementary Knowledge on Medium Access Control**

Motivation for a specialized MAC, Hidden and exposed terminals, Near and far terminals, Introduction to SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access, CDMA, Spread Aloha multiple access, Mobile communications, Comparison of S/T/F/CDMA.

#### **Unit III: Elementary Knowledge on Telecommunications Systems**

GSM: Mobile services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, New data services, DECT: System architecture, Protocol architecture. Elementary Knowledge on Satellite systems: History, Applications, Basics: GEO, LEO, MEO, Routing, Localization, Handover.

#### **Unit IV: Mobile Internet**

Introducing the Mobile Internet, Services for the mobile Internet, Business opportunities. **Implementing WAP Services: WML:** WML Variables and Contexts: Variable Substitution, Setting Variables, Browser Contexts.

#### **Unit V: WAP**

The Mobile Internet Standard, Making the Internet Mobile: Challenges and Pitfalls, Overview of the Wireless Application Protocol, **Implementing WAP Services: WML Script:** Data types, Variables, and Conversions, Operators and Expressions: Operand

Conversions, Assignment Operators, Arithmetic Operators, Bitwise Operators, Shift Operators, Logical Operators, Increment and Decrement Operators, Comparison Operators, Type Operators, The Conditional Operator, The Comma Operator, Precedence and Associativity, WML Script Statements: Expressions as Statements, Blocks of Statements, Conditions, Loops, Returning from a Function, Other Statements, WML Script, Dialogs

#### **Suggested Readings:**

1. Jochen Schiller, "Mobile Communications", PHI/Pearson Education, Second Edition, 2003.
2. Sandeep Singhal, "Internet", Pearson Education, 2000
3. Learning WML, and WML Script, Programming the Wireless Web, Martin Frost, Publisher: O'Reilly 2000
4. William Stallings, "Wireless Communications and Networks", PHI/Pearson Education, 2002

**Course Name: Major Project**

**Course Code: 13013600**

#### **Course Outline**

Students are required to develop projects under mentorship of faculty in any of the application; web based includes data base handling.

**Course Name: Machine Learning**

**Course Code: 11026600**

#### **Unit I**

Introduction to ML, Goals and applications of machine learning. Aspects of developing a learning system: training

and testing data. Types of learning: Supervised, Unsupervised, and Reinforcement. Linear regression, variance,

bias, gradient descent,  $R^2$ , Ridge and Lasso regression.

#### **Unit II**

Logistic regression, decision boundary, classification parameters: Accuracy, precision, recall, F-measure, RoC curve. Bayesian learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Regression tree –random forest

#### **Unit III**

Perceptron and backpropagation neural network - k-nearest neighbour rule. Support vector machine: multicategory



generalizations, Kernels for learning non-linear functions. ADA Boost classifier. Feature engineering and feature selection. PCA and LDA

#### **Unit IV**

Unsupervised learning. Clustering: Learning from unclassified data. Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering. Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labeled and unlabeled data.

#### **Unit V**

Deep learning: Deep Neural network, Activation functions, Cost function, feed forward network, CNN, Sequential Models.

## 9.Lesson Plans

### 13013100 – Software Testing and Quality Assurance

| Unit    | Particulars  | Class No. | Pedagogy of Class     |
|---------|--|-----------|-----------------------|
| Unit-I  | Software Development Life Cycle                                    | C-1       | Lecture               |
| Unit-I  | Software Development Life Cycle                                    | C-2       | Lecture               |
| Unit-I  | Software Testing – Psychology of Testing,                          | C-3       | Lecture               |
| Unit-I  | Software Testing – Psychology of Testing,                          | C-4       | Lecture               |
| Unit-I  | Verification and Validation, Testing Team and Development Team     | C-5       | Lecture               |
| Unit-I  | Verification and Validation, Testing Team and Development Team     | C-6       | Lecture               |
|         |  | C-7       | Lecture               |
| Unit-I  | Characteristics of Test Engineers                                  | C-8       | Lecture               |
| Unit-I  | Levels of Testing  | C-9       | Lecture               |
| Unit-I  | Top-Down versus Bottom-Up Testing                                  | C-10      | Lecture               |
| Unit-I  | Testing – Black Box  | C-11      | Lecture               |
| Unit-I  | Black Box Testing  | C-12      | Lecture               |
| Unit-I  | White Box Testing  | C-13      | Lecture               |
| Unit-I  | White Box Testing  | C-14      | Lecture               |
| Unit-I  | Gorilla Testing, Beta Testing, Field Testing                       | C-15      | Lecture               |
| Unit-I  | Gorilla Testing, Beta Testing, Field Testing                       | C-16      | Lecture               |
| Unit-I  | Performance, Stress and Acceptance Testing                         | C-17      | Lecture               |
| Unit-I  | Testing Criteria for Completion of Testing                         | C-18      | Lecture               |
| Unit-I  | Manual Testing and its Limitations.                                | C-19      | Lecture               |
|         | Clarification Class  | C-20      | Clarification Class   |
|         | Activity   | C-21      | Activity              |
|         | Class Room assignment  | C-22      | Class Room Assignment |
| Unit-II | Overview of Testing Tools – Need for Automated Testing Tools,      | C-23      | Lecture               |
| Unit-II | Overview of Testing Tools – Need for Automated Testing Tools,      | C-24      | Lecture               |
| Unit-II | Taxonomy of Testing Tools  | C-25      | Lecture               |
| Unit-II | Functional/Regression Testing Tools,                               | C-26      | Lecture               |
| Unit-II | Functional/Regression Testing Tools,                               | C-27      | Lecture               |
| Unit-II | Performance Testing Tools  | C-28      | Lecture               |
| Unit-II | Testing Management Tools   | C-29      | Lecture               |
| Unit-II | Source Code Testing Tools  | C-30      | Lecture               |
| Unit-II | How to select a Testing Tool.<br>WinRunner – Overview of WinRunner | C-31      | Lecture               |
| Unit-II | How to select a Testing Tool.<br>WinRunner – Overview of WinRunner | C-32      | Lecture               |
| Unit-II | How to select a Testing Tool.<br>WinRunner – Overview of WinRunner | C-33      | Lecture               |
| Unit-II | Testing Applications using WinRunner                               | C-34      | Lecture               |
| Unit-II | Testing Applications using WinRunner                               | C-35      | Lecture               |
|         | Clarification Class  | C-36      | Clarification Class   |
|         | Presentation   | C-37      | Presentation          |

|          |  |      |                       |
|----------|--|------|-----------------------|
|          | Guest Lecture  | C-38 | Guest Lecture         |
|          | Class Room assignment  | C-39 | Class Room Assignment |
|          | Webinar  | C-40 | Webinar               |
|          | Take Home Assignment   |      | Take Home Assignment  |
| Unit-III | Software Quality Assurance                                     | C-41 | Lecture               |
| Unit-III | Software Quality Assurance                                     | C-42 | Lecture               |
| Unit-III | Criteria for the Success of Software Project                   | C-43 | Lecture               |
| Unit-III | Process-Oriented Software Development, the Management Process. | C-44 | Lecture               |
| Unit-III | Process-Oriented Software Development, the Management Process. | C-45 | Lecture               |
| Unit-III | Metrics in Software Development, Documentation                 | C-46 | Lecture               |
| Unit-III | Metrics in Software Development, Documentation                 | C-47 | Lecture               |
| Unit-III | Clarification Class  | C-48 | Clarification Class   |
|          | Presentation   | C-49 | Presentation          |
|          | Class Room assignment  | C-50 | Class Room Assignment |
|          | Seminar  | C-51 | Seminar               |
|          | Activity   | C-52 | Acitivity             |
|          | Take Home Assignment-2   |      | Take Home Assignment  |
| Unit- IV | Quality Standards, ISO 9000 Series Standards                   | C-53 | Lecture               |
| Unit- IV | Quality Standards, ISO 9000 Series Standards                   | C-54 | Lecture               |
| Unit- IV | Quality Process Implementation Issues                          | C-55 | Lecture               |
| Unit- IV | Quality Process Implementation Issues                          | C-56 | Lecture               |
| Unit- IV | Quality Process Implementation Issues                          | C-57 | Lecture               |
| Unit- IV | Clarification Class  | C-58 | Clarification Class   |
| Unit- IV | Presentation   | C-59 | Presentation          |
|          | Class Room assignment  | C-60 | Class Room Assignment |

### 13013200 – Theory of Computation

| Unit    | Particulars  | Class No. | Pedagogy of Class     |
|---------|--|-----------|-----------------------|
| Unit-I  | Finite State Machine, Recursive definitions, Regular Expressions,  | C-1       | Lecture               |
| Unit-I  | definitions of Finite State Machine, Transition Graphs, Deterministic & Non-Deterministic                | C-2       | Lecture               |
| Unit-I  | Finite State Machines,   | C-3       | Lecture               |
| Unit-I  | Thomson's & Subset Algorithm to convert regularExpression to NDFSM & NDFSM to FSM                        | C-4       | Lecture               |
| Unit-I  | Thomson's & Subset Algorithm to convert regular Expression to NDFSM & NDFSM to FSM                       | C-5,6     | Lecture               |
| Unit-I  | Thomson's & Subset Algorithm to convert regularExpression to NDFSM & NDFSM to FSM                        | C-7,8     | Lecture               |
| Unit-I  | Regular Grammar left linear and right linear.  | C-9,10    | Lecture               |
| Unit-I  | Finite State Machine with output (Moore machineand Melay Machine)  | C-11,12   | Lecture               |
| Unit-I  | Conversion of Moore machine to Melay Machine & Vice-Versa,   | C-13      | Lecture               |
| Unit-I  | Conversion of Moore machine to Melay Machine &Vice-Versa,  | C-14      | Lecture               |
| Unit-I  | Pumping Lemma, Properties and limitations offinite state machine   | C-15,16   | Lecture               |
| Unit-I  | Presentation   | C-17      | Presentation          |
| Unit-I  | Clarification Class  | C-18      | Clarification Class   |
|         | Take Home Assignments  |           | Take Home Assignments |
|         | Activity   | C-19      | Activity              |
| Unit-II | Context free Grammar design  | C-20      | Lecture               |
| Unit-II | Normal Form CNF, GNF   | C- 21,22  | Lecture               |
| Unit-II | Push down Stock machine, Context free Grammar  | C-23,24   | Lecture               |
| Unit-II | Presentation   | C-25      | Presentation          |
| Unit-II | Properties of context free grammar: Union, Closure & Intersection, Pumping lemma for context freegrammar | C-26,27   | Lecture               |
| Unit-II | Properties of context free grammar: Union, Closure& Intersection, Pumping lemma for context free grammar | C-28,29   | Lecture               |
| Unit-II | Webinar  | C-30      | Webinar               |
| Unit-II | Take Home Assignments  |           | Take Home Assignments |

|          |   |          |                       |
|----------|---|----------|-----------------------|
| Unit-II  | Parser Design and Push Down stock machine, CYK algorithm, Earley's Algorithm                                | C-31,32  | Lecture               |
| Unit-II  | Clarification Class   | C-33     | Clarification Class   |
| Unit-II  | Class Room Assignment   | C-34     | Class Room Assignment |
| Unit-III | Turing machine, Post machine,   | C-35     | Lecture               |
| Unit-III | Conversion of Turing to Post-Wang and vice versa, Combining Turing machine, Chomsky Hierarchy.              | C -36    | Lecture               |
| Unit-III | Conversion of Turing to Post-Wang and vice versa, Combining Turing machine, Chomsky Hierarchy.              | C-37,38  | Lecture               |
| Unit-III | Presentation  | C-39     | Presentation          |
| Unit-III | Conversion of Turing to Post-Wang and vice versa, Combining Turing machine, Chomsky Hierarchy.              | C-40     | Lecture               |
| Unit-III | Church's Thesis, Primitive Recursion Functions, Godelization  | C-41     | Lecture               |
| Unit-III | Universal Turing machine  | C-42     | Lecture               |
|          | Clarification Class   | C-43     | Clarification Class   |
|          | Class Room Assignment   | C-44     | Class Room Assignment |
| Unit-IV  | Halting Problem, Turing Enumerability   | C-45,46  | Lecture               |
| Unit-IV  | Turing Acceptability and Turing Decidabilities.   | C-47     | Lecture               |
| Unit-IV  | Guest lecture   | C-48     | Guest lecture         |
| Unit-IV  | Class Room Assignment   | C-49     | Class Room Assignment |
| Unit-IV  | Webinar   | C-50     | Webinar               |
| Unit-IV  | Unsolvable problems about Turing machines,  | C-51,52  | Lecture               |
| Unit-IV  | Unsolvable problems about Grammar and similar system Computation Complexity: P, NP and NP complete problems | C -53,54 | Lecture               |
| Unit-IV  | Activity  | C-55     | Activity              |
| Unit-IV  | Unsolvable problems about Grammar and similar system Computation Complexity: P, NP and NP complete problems | C-56     | Lecture               |
| Unit-IV  | Unsolvable problems about Grammar and similar system Computation Complexity: P, NP and NP complete problems | C-57     | Lecture               |
| Unit-IV  | Seminar   | C-58     | Seminar               |
| Unit-IV  | Class Room Assignment   | C-59     | Class Room Assignment |
| Unit-IV  | Clarification Class   | C-60     | Clarification Class   |

**13013300 – Unix & Shell Programming**

| Unit    | Particulars  | Class No. | Pedagogy of Class     |
|---------|--|-----------|-----------------------|
| Unit-I  | Unix Architecture  | C-1       | Lecture               |
| Unit-I  | Feature of Unix  | C-2       | Lecture               |
| Unit-I  | Posix and the single Unix Specification  | C-3       | Lecture               |
| Unit-I  | Locating Commands  | C-4       | Lecture               |
| Unit-I  | Internal and External commands   | C-5       | Lecture               |
| Unit-I  | Command Structure  | C-6       | Lecture               |
| Unit-I  | Flexibility of Command usage   | C-7       | Lecture               |
| Unit-I  | Man browsing the Manual pages online   | C-8       | Lecture               |
| Unit-I  | understanding the man documentation  | C-9       | Lecture               |
| Unit-I  | further help with man -k, apropos and what is  | C-10      | Lecture               |
| Unit-I  | Cal, date, echo, printf, who, uname, tty, passwd,  | C-11      | Lecture               |
| Unit-I  | Unix operating system  | C-12      | Lecture               |
|         | Clarification Class  | C-13      | Clarification Class   |
|         | Class Room Assignment  | C-14      | ClassRoom Assignment  |
|         | Home Assignment  |           | Take Home Assignments |
| Unit-I  | what is File Name, parent-child relationship, pwd,mkdir, rmdir                                 | C-15      | Lecture               |
| Unit-I  | Home variable: the home directory  | C-16      | Lecture               |
| Unit-I  | Unix File System, The Bourne Shell, Simple filters, Advanced Filters – I,Advanced Filters - II | C-17      | Lecture               |
| Unit-II | cat, cp, rm, mvwc, od, cmp, com, diff, gzip, gunzip  | C-18      | Lecture               |
| Unit-II | ls -l, -d option, file ownership, file permission,changing file ownership                      | C-19      | Lecture               |
| Unit-II | vi basic, saving text and quitting   | C-20      | Lecture               |
| Unit-II | Navigation, editing text, repeating last command   | C-21      | Lecture               |
| Unit-II | searching for pattern, substitution redirection: threestandard file                            | C-22      | Lecture               |
| Unit-II | pipes, tee, command substitution, ps, system processes -e or -a                                | C-23      | Lecture               |
| Unit-II | mechanism of process creation, internal and externalcommand                                    | C-24      | Lecture               |
| Unit-II | process state and zombies, nice: job execution with low priority, killing process with signal  | C-25      | Lecture               |
| Unit-II | at and batch command, job control, cron and timecommand  | C-26      | Lecture               |
|         | Clarification Class  | C-27      | Clarification Class   |
|         | Presentation   | C-28      | Presentation          |
|         | Home Assignment  |           | Take Home Assignment  |

|          |  |      |                       |
|----------|--|------|-----------------------|
|          | Class Room Assignment  | C-29 | Class Room Assignment |
| Unit-III | Line editing with ex, Vi editor The Process,communication and scheduling       | C-30 | Lecture               |
| Unit-III | cut, paste, sort, uniq, tr, grep command                                       | C-31 | Lecture               |
| Unit-III | basic regular expression, sed, line addressing                                 | C-32 | Lecture               |
| Unit-III | read, command line argument  | C-33 | Lecture               |
| Unit-III | exit amnd exit status of command   | C-34 | Lecture               |
| Unit-III | Seminar  | C-35 | Seminar               |
| Unit-III | case conditional, expr, while, f or, set and shift, trapinterrupting a command | C-36 | Lecture               |
| Unit-III | debugging shell script with set -x   | C-37 | Lecture               |
| Unit-III | Class Room Assignment  | C-38 | Lecture               |
|          | Clarification Class  | C-39 | Clarification Class   |
|          | Presentation   | C-40 | Presentation          |
| Unit-IV  | Programming with the Shell Introduction to Systemadministration                | C-41 | Lecture               |
| Unit-IV  | root: the system administrator login   | C-42 | Lecture               |
| Unit-IV  | the administrator privileges, maintaining security                             | C-43 | Lecture               |
| Unit-IV  | startup and shutdown, managing disk apce, device files, cpio, tar              | C-44 | Lecture               |
| Unit-IV  | Clarification Class  | C-45 | Clarification Class   |

**13013400 – Unix & Shell Programming Lab**

| S. No. | Particulars  | Class No. | Pedagogy of Class   |
|--------|--|-----------|---------------------|
| 1      | Basic Commands in unix, VI editor                                      | P-1       | Practical           |
| 2      | Shell Programming, File Permission                                     | P-2       | Practical           |
| 3      | Write a program to check whether a given string is palindrome or not.  | P-3       | Practical           |
| 4      | Simple Interest, Global and Internal Variables, ExternVariables        | P-4       | Practical           |
| 5      | Activity   | P-5       | Activity            |
| 6      | Bitwise operators, Size of data Types, SwitchStatement, Area of Circle | P-6       | Practical           |
| 7      | Nested If-else, Do while   | P-7       | Practical           |
| 8      | For Loop, other scrpitng Programms                                     | P-8       | Activity            |
| 9      | Nano and emacs editor in Linux   | P-9       | Practical           |
| 10     | C Programs in Linux  | P-10      | Practical           |
| 11     | To search a pattern using grep and fgrep command                       | P-11      | Practical           |
| 12     | Linux Administration command   | P-12      | Practical           |
| 13     | Linux Networking   | P-13      | Practical           |
| 14     | Linux Networking   | P-14      | Practical           |
| 15     | Clarification Class  | P-15      | Clarification Class |



### 13012700 – Mobile Computing

| Unit     | Particulars   | Class No. | Pedagogy of Class   |
|----------|---|-----------|---------------------|
| Unit-I   | Introduction of MOC and their history, Applications, Issues.  | C-1       | Lecture             |
| Unit-I   | Market of Mobile Communications, Frequency of Radio Transmission.   | C-2       | Lecture             |
| Unit-I   | Analog and Digital Signals, Antennas, Signal Propagation, Transmission Path of Propagation.   | C-3       | Lecture             |
| Unit-I   | About Multiplexing, Frequency Multiplexing, Time Division Multiplexing and their Signal Diagram.  | C-4       | Lecture             |
| Unit-I   | Code Division Multiplexing, Space Division Multiplexing, Wavelength Division Multiplexing.  | C-5       | Lecture             |
| Unit-I   | Modulation: Amplitude, Phase, Frequency Shift Keying, Multicarrier Modulation, Spread Spectrum: Direct Sequence, Frequency Hopping, Cellular System | C-6       | Lecture             |
|          | Clarification Class 1   | C-7       | Clarification Class |
|          | Class Room Assignment 1   | C-8       | Class Assignment    |
|          | Presentation 1  | C-9       | Presentation        |
|          | Take Home Assignments 1   |           | Home Assignments    |
| Unit-II  | Motivation for a specialized MAC, Hidden and exposed terminals, Near and far terminals  | C-10      | Lecture             |
| Unit-II  | Introduction to SDMA, FDMA, TDMA  | C-11      | Lecture             |
| Unit-II  | Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access  | C-12      | Lecture             |
| Unit-II  | Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA  | C-13      | Lecture             |
| Unit-II  | Multiple access with collision avoidance  | C-14      | Lecture             |
| Unit-II  | Polling, Inhibit sense multiple access, CDMA  | C-15      | Lecture             |
| Unit-II  | Spread Aloha multiple access, Mobile communications   | C-16      | Lecture             |
| Unit-II  | Comparison of S/T/F/CDMA  | C-17      | Lecture             |
|          | Clarification Class   | C-18      | Clarification Class |
|          | Class Room Assignment   | C-19      | Class Assignment    |
|          | Presentation  | C-20      | Presentation        |
|          | Quiz  | C-21      | Quiz                |
|          | Webinar   | C-22      | Webinar             |
|          | Guest lecture 1   | C-23      | Guest lecture       |
| Unit-III | GSM: Mobile services, System architecture, Radio interface  | C-24      | Lecture             |

|          |   |      |                     |
|----------|---|------|---------------------|
| Unit-III | Protocols, Localization and calling, Handover                           | C-25 | Lecture             |
| Unit-III | Security, New data services   | C-26 | Lecture             |
| Unit-III | DECT: System architecture, Protocol architecture                        | C-27 | Lecture             |
| Unit-III | Elementary Knowledge on Satellite systems:<br>History, Applications     | C-28 | Lecture             |
| Unit-III | Basics and architecture: GEO  | C-29 | Lecture             |
| Unit-III | MEO, Routing, Localization, Handover                                    | C-30 | Lecture             |
| Unit-III | LEO Basics and Architecture   | C-31 | Lecture             |
|          | Clarification Class   | C-32 | Clarification Class |
|          | Class Room Assignment   | C-33 | Class Assignment    |
|          | Presentation  | C-34 | Presentation        |
|          | Take Home Assignments   |      | Home Assignments    |
| Unit-IV  | Introducing the Mobile Internet, Services<br>for the mobile Internet    | C-35 | Lecture             |
| Unit-IV  | Business opportunities  | C-36 | Lecture             |
| Unit-IV  | Implementing WAP Services: WML: WML<br>Variables                        | C-37 | Lecture             |
| Unit-IV  | Contexts: Variable Substitution, Setting<br>Variables, Browser Contexts | C-38 | Lecture             |
| Unit-IV  | The Mobile Internet Standard  | C-39 | Lecture             |
| Unit-IV  | Challenges and Pitfalls of Making the Internet<br>Mobile                | C-40 | Lecture             |
| Unit-IV  | Overview of the Wireless Application Protocol                           | C-41 | Lecture             |
| Unit-IV  | WML Script: Data types, Variables, and<br>Conversions                   | C-42 | Lecture             |
| Unit-IV  | Operators and Expressions   | C-43 | Lecture             |
| Unit-IV  | Operand Conversions, Assignment<br>Operators, Arithmetic Operators      | C-44 | Lecture             |
| Unit-IV  | Bitwise Operators, Shift Operators, Logical<br>Operators                | C-45 | Lecture             |
| Unit-IV  | Increment and Decrement Operator ,<br>Comparison Operators              | C-46 | Lecture             |
| Unit-IV  | Type Operators, The Conditional Operator,<br>The Comma Operator         | C-47 | Lecture             |
| Unit-IV  | Precedence and Associativity  | C-48 | Lecture             |
| Unit-IV  | WML Script Statements   | C-49 | Lecture             |
| Unit-IV  | Expressions as Statements, Blocks of Statements                         | C-50 | Lecture             |
| Unit-IV  | Conditions, Loops   | C-51 | Lecture             |
| Unit-IV  | Returning from a Function, Other Statements                             | C-52 | Lecture             |
| Unit-IV  | WML Script, Dialogs   | C-53 | Lecture             |
| Unit-IV  | WML Design Architecture   | C-54 | Lecture             |
|          | Clarification Class   | C-55 | Clarification Class |
|          | Class Room Assignment   | C-56 | Class Assignment    |
|          | Quiz  | C-57 | Quiz                |
|          | Webinar   | C-58 | Webinar             |
|          | Seminar   | C-59 | Seminar             |
|          | Guest lecture   | C-60 | Guest lecture       |

**11026600 – Machine Learning**

| Unit     | Particulars   | Class No. | Pedagogy of Class   |
|----------|---|-----------|---------------------|
| Unit-I   | Introduction to ML, Goals and applications of machine learning              | C-1       | Lecture             |
| Unit-I   | Introduction to ML, Goals and applications of machine learning              | C-2       | Lecture             |
| Unit-I   | Aspects of developing a learning system: training and testing data.         | C-3       | Lecture             |
| Unit-I   | Types of learning: Supervised, Unsupervised, and Reinforcement              | C-4       | Lecture             |
| Unit-I   | Linear regression, variance, bias, gradient descent                         | C-5       | Lecture             |
| Unit-I   | R2, Ridge and Lasso regression  | C-6       | Lecture             |
|          | Clarification Class 1   | C-7       | Clarification Class |
|          | Class Room Assignment 1   | C-8       | Class Assignment    |
|          | Presentation 1  | C-9       | Presentation        |
|          | Take Home Assignments 1   |           | Home Assignments    |
| Unit-II  | Logistic regression, decision boundary, classification parameters: Accuracy | C-10      | Lecture             |
| Unit-II  | precision, recall, F-measure, RoC curve                                     | C-11      | Lecture             |
| Unit-II  | precision, recall, F-measure, RoC curve                                     | C-12      | Lecture             |
| Unit-II  | Bayesian learning: Probability theory and Bayes rule.                       | C-13      | Lecture             |
| Unit-II  | Bayesian learning: Probability theory and Bayes rule.                       | C-14      | Lecture             |
| Unit-II  | Naive Bayes learning algorithm  | C-15      | Lecture             |
| Unit-II  | Regression tree – random forest   | C-16      | Lecture             |
| Unit-II  | Regression tree – random forest   | C-17      | Lecture             |
|          | Clarification Class   | C-18      | Clarification Class |
|          | Class Room Assignment   | C-19      | Class Assignment    |
|          | Presentation  | C-20      | Presentation        |
|          | Quiz  | C-21      | Quiz                |
|          | Webinar   | C-22      | Webinar             |
|          | Guest lecture 1   | C-23      | Guest lecture       |
| Unit-III | Perceptron and backpropagation neural network                               | C-24      | Lecture             |
| Unit-III | k-nearest neighbour rule  | C-25      | Lecture             |
| Unit-III | k-nearest neighbour rule  | C-26      | Lecture             |
| Unit-III | Support vector machine: multicategory generalizations                       | C-27      | Lecture             |
| Unit-III | Support vector machine: multicategory generalizations                       | C-28      | Lecture             |
| Unit-III | Kernels for learning non-linear functions. ADA Boost classifier             | C-29      | Lecture             |

|          |   |      |                     |
|----------|---|------|---------------------|
| Unit-III | Feature engineering and feature selection. PCA and LDA                            | C-30 | Lecture             |
| Unit-III | Feature engineering and feature selection. PCA and LDA                            | C-31 | Lecture             |
|          | Clarification Class   | C-32 | Clarification Class |
|          | Class Room Assignment   | C-33 | Class Assignment    |
|          | Presentation  | C-34 | Presentation        |
|          | Take Home Assignments   |      | Home Assignments    |
| Unit-IV  | Unsupervised learning.  | C-35 | Lecture             |
| Unit-IV  | Clustering: Learning from unclassified data.                                      | C-36 | Lecture             |
| Unit-IV  | Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering | C-37 | Lecture             |
| Unit-IV  | Clustering. Hierarchical Agglomerative Clustering. k-means partitional clustering | C-38 | Lecture             |
| Unit-IV  | Expectation maximization (EM) for soft clustering                                 | C-39 | Lecture             |
| Unit-IV  | Expectation maximization (EM) for soft clustering                                 | C-40 | Lecture             |
| Unit-IV  | Semi-supervised learning with EM using labeled and unlabeled data.                | C-41 | Lecture             |
| Unit- IV | Semi-supervised learning with EM using labeled and unlabeled data.                | C-42 | Lecture             |
| Unit- IV | Semi-supervised learning with EM using labeled and unlabeled data.                | C-43 | Lecture             |
| Unit-V   | Deep learning: Deep Neural network  | C-44 | Lecture             |
| Unit-V   | Deep learning: Deep Neural network  | C-45 | Lecture             |
| Unit-V   | Deep learning: Deep Neural network  | C-46 | Lecture             |
| Unit-V   | Activation functions  | C-47 | Lecture             |
| Unit-V   | Activation functions  | C-48 | Lecture             |
| Unit-V   | Cost function, feed forward network   | C-49 | Lecture             |
| Unit-V   | Cost function, feed forward network   | C-50 | Lecture             |
| Unit-V   | CNN, Sequential Models  | C-51 | Lecture             |
| Unit-V   | CNN, Sequential Models  | C-52 | Lecture             |
| Unit-V   | CNN, Sequential Models  | C-53 | Lecture             |
| Unit-V   | CNN, Sequential Models  | C-54 | Lecture             |
|          | Clarification Class   | C-55 | Clarification Class |
|          | Class Room Assignment   | C-56 | Class Assignment    |
|          | Quiz  | C-57 | Quiz                |
|          | Webinar   | C-58 | Webinar             |
|          | Seminar   | C-59 | Seminar             |
|          | Guest lecture   | C-60 | Guest lecture       |

**Note:** The review of Syllabus happens on a periodic basis for the benefit of the students. Incase there are changes in curriculum due to review, students would be intimated in writing.

----- End of document-----